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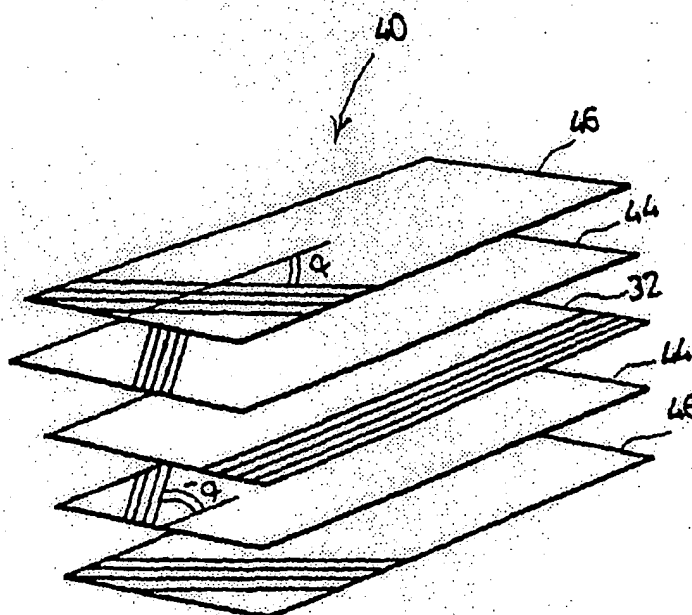
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(54) Title: THIN-WALLED CYLINDER MADE FROM FIBRE-REINFORCED PLASTICS MATERIAL



(57) Abstract: The present invention relates to a thin-walled hollow cylinder (12) made from fibre-reinforced plastics material, the cylinder wall of which is composed of at least one layer (20; 32, 34; 32, 44, 46) having fibres with at least one oriented direction of the fibres, and the total wall thickness d_{tot} lying in the range from 10 to 1000 μm , and the ratio d_{tot}/D being ≤ 0.0025 . The oriented direction(s) of the fibres are selected depending on the intended final application. Examples include, inter alia, multi-layer laminates made from carbon/epoxy, used for the production of a cylinder of this nature, having at least one layer with an oriented direction of the fibres which is parallel or perpendicular to the longitudinal axis of the cylinder.

Thin-walled cylinder made from fibre-reinforced plastics material

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The present invention relates to a thin-walled hollow, cylinder made from fibre-reinforced plastics material.

A hollow cylinder with a relatively great wall thickness, used as a drive shaft, is known, for example, from
10 DE-A-29 11 167. This known cylinder is of layered structure and comprises at least four layers which contain oriented glass or carbon fibres at defined angles with respect to the longitudinal axis of the shaft. According to this publication, the innermost layer with oriented glass fibres at an angle of $\pm 30^\circ$ to $\pm 50^\circ$
15 serves as a primary support for absorbing shear loads. A first intermediate layer with oriented glass fibres at an angle of 0° to $\pm 15^\circ$ has the function of increasing the wall thickness in order to counteract torsion during use. A further intermediate layer, which contains carbon fibres with an orientation of 0° to
20 15° , serves to stiffen the shaft so that the usual sound/noise from a shaft in operation can be suppressed. Finally, the shaft is provided with an outermost, impact-resistant protective layer with glass fibres oriented at an angle of $\pm 60^\circ$ to 90° , which likewise contributes to resist torsion. The total wall thickness
25 according to the examples is approximately 3.0 mm.

Furthermore, DE-A-25 20 623 has disclosed a tube made from fibre-reinforced plastics material, for example for use in the aeronautical and aerospace sectors, which comprises a plurality of layers containing optionally oriented fibres.
30 EP-A-0 058 783 has disclosed a tubular body which comprises a plurality of plastics layers and with an outermost finishing layer, for example a mast, in which it is preferable for a combination of different fibres to be used.

A thin-walled hollow cylinder is described, for example,
35 in NL-A-8802144, which is used to produce a so-called "galvano" printing forme, perforations in the form of a grid of dots being formed in the cylinder wall by means of a laser. This known cylinder is made from plastics material to which solid particles and/or fibres may be added in order to increase the mechanical
40 stability and strength. Galvano printing formes made from

plastics material of this nature have never achieved commercial success.

In addition to the abovementioned use for the production of an galvano printing forme, thin-walled hollow cylinders, often made from metal such as Ni, are also used for other printing applications, for example for relief printing and gravure printing, in which a relief comprising recesses is made into the outer surface of the cylinder, for example with the aid of a laser, or for use as a thin metal support for printing plates for flexographic printing which can be fitted on and removed from an air roller. Other applications for thin-walled hollow cylinders of this nature include, inter alia, the use as a transfer medium for transferring coatings and inks, an electrically conductive cylinder as an electroforming mould, as a coating material, for example as a surface with specific frictional/sliding properties, on an optionally driven roller.

In a number of these applications, it is important that it be possible to process the material of the cylinder with the aid of a laser, which means that the wall thickness must not exceed a defined upper limit. Furthermore, in some printing applications, in which the cylinder is not supported over the entire circumferential surface, but rather only at the ends of the cylinder, for example in end rings, but also in other applications, a thin cylinder of this nature has to be rigid (in the longitudinal direction), certainly if the lengths are relatively great, so that the cylinder is easy to handle, is not damageable and the bending of this cylinder is within acceptable limits.

Furthermore, it is difficult to float nickel cylinders of small diameter on rollers in which the cylinder diameter is increased with the aid of air, such as for example in flexographic printing. Nickel cylinders with a small diameter of this nature are also relatively difficult to produce. In addition, thin nickel cylinders are susceptible to creasing. However, cylinders with a greater wall thickness and therefore a reduced susceptibility to creasing are expensive and more difficult to float.

Thin-walled metal cylinders are often transported and stored with the cylinders pushed together in the shape of a kidney. However, this is only possible from a certain diameter.

Consequently, there is ongoing demand for cylinders with
5 properties which are improved for the intended application, transport and (temporary) storage.

As has already been suggested, in accordance with NL-A-8802144, plastics can generally be made more mechanically stable by the addition of fillers and/or fibres. However, this
10 Dutch patent application does not provide any insight into how the intended increase in mechanical stability can be achieved.

It is noted that US-A-3 981 237 has disclosed a rotary printing screen made from plastics material, such as polyester. The plastics material may be filled with a reinforcing material
15 such as glass fibres. Such a rotary printing screen is manufactured from a tubular blank made by conventional extrusion methods, which is stretched biaxially afterwards. These filler materials are (short) chopped fibres, which are distributed randomly in the plastics material, even after biaxially
20 stretching. Accordingly the volume concentration of the fibers is 40% at maximum. However, the strength and rigidity of a screen thus manufactured leaves much to be desired. The tubular blank may be perforated by laser radiation to provide the screen openings.

Furthermore it is noted that JP-A-11 278817 has disclosed a cylinder structure made from a carbon fibre-reinforced material. This cylinder structure has a relatively thick wall in view of its application as an insulating cylinder in an apparatus for the production of silicon single crystals
25 using the Czochralski process.

The other publications mentioned above disclose relatively thick-walled hollow cylinders which are not suitable for the abovementioned applications.

In the prior art, it is generally thought to be
35 impossible to produce hollow cylinders from fibre-reinforced plastics material with a relatively great diameter and a small wall thickness (at most approximately 1 mm) which nevertheless have the required mechanical and chemical properties for the abovementioned applications.

Furthermore, it is known that under load plastics materials are deformed more easily than metal, such as nickel, on account of creep.

The object of the present application is to provide a
5 thin-walled hollow cylinder made from fibre-reinforced plastics material, in which the wall thickness of the cylinder is such that it can be processed as an intermediate product with the aid of high-energy radiation, while the rigidity is certainly sufficient for numerous other applications, the cylinder being
10 used with optional support and/or with optional rotation.

Another object of the invention is to provide a thin-walled hollow cylinder of this type made from fibre-reinforced plastics material of this nature, the mechanical properties of which are improved compared to the printing forme made from
15 (fibre-reinforced) plastics material described in the abovementioned Dutch patent application 8802144.

The invention provides a thin-walled hollow cylinder made from fibre-reinforced plastics material, comprising at least one layer having fibres with at least one oriented
20 direction of the fibres, the total wall thickness d^{tot} lying in the range from 0.010 to 1 mm (10 to 1000 μm), and the ratio d^{tot}/D being ≤ 0.0025 , where D is the diameter (in mm) of the cylinder. According to the invention, it has proven possible to create a very thin sleeve with a maximum wall thickness of 1 mm
25 which has a continuous outer surface which can be made smooth and which can be produced within accurate dimensional tolerances, and for which little material is required. As an aside, it is noted that further machining will in many cases be unnecessary.

30 Preferably the total wall thickness d^{tot} is within the range of 0.010 to 0.700 mm, more preferably within the range of 0.020-0.300 mm.

For example, at a wall thickness of 80 μm , the minimum diameter is 32 mm, and at a wall thickness of 1000 μm the
35 minimum diameter of the cylinder is 400 mm. The cylinder is preferably circular in cross section and has a D/L ratio of < 1 , where L is the length (in mm) of the cylinder.

A lightweight cylinder according to the invention is eminently suitable for use as a sleeve on a rapidly rotating

roll or roller, such as for offset printing (1000 rpm), without this sleeve coming off the roller as a result of the centrifugal force. By suitably selecting plastics material(s) and fibre type(s), which have no yield point or a high yield point, it is possible to produce cylinders which are not susceptible to creasing. Compared to metal, in particular nickel, plastics are generally more corrosion-resistant and better able to withstand chemicals, which is advantageous if a cylinder according to the invention is used in aggressive media, such as when printing.

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10 Given the ratio of wall thickness to diameter which is defined above, it is possible for a plurality of cylinders according to the invention which are not being used to be transported and stored with ease in the shape of a kidney. The cylinders can easily be produced seamlessly, so that there are no

15 inhomogeneities caused by a weld seam. Compared to metal cylinders, operations such as cutting and perforating are easy to carry out with the cylinders according to the invention.

A single plastics layer with fibres incorporated therein which are oriented in one direction (also referred to below as

20 unidirectional fibres) has anisotropic elastic properties, i.e. the properties are dependent on the direction in which the load is acting.

In this specification a fibre-reinforced plastics material is meant to be a plastics matrix layer, wherein

25 reinforcing fibres are incorporated. According to the invention these fibres are oriented in one direction.

It is known that the addition of fibres generally imparts an improved rigidity to plastics materials. Fibres may be added in the form of so-called short fibres (also known as

30 "chopped fibres"), as long fibres which are arbitrarily distributed in the plastics material, and as unidirectional fibres. The use of unidirectional fibres in principle provides the highest rigidity which can be achieved. Furthermore, the highest fibre content can be achieved with layers having

35 unidirectional fibres, and consequently it is with these fibres that the highest modulus of elasticity can be attained.

As has already been stated, a single plastics layer having unidirectional fibres has anisotropic elastic properties. According to the invention, this anisotropy is used to limit the

deformation in the direction of load, which occurs in the various applications. This direction of load and therefore the oriented direction of the fibres of the cylinder may differ for each other application.

5 For certain applications, it is also possible that a plurality of loads may act on the cylinder simultaneously but in different directions, for example if a galvano printing forme for rotary screen printing is produced from the cylinder. According to one embodiment, the cylinder according to the
10 invention therefore comprises a fibre-reinforced layer having fibres with two differently oriented directions of the fibres, such as a woven or braided fabric of fibres, a fibre mat or a fibre cloth.

To reduce the total amount of bending, in particular in
15 the case of long cylinders, it is preferable for an oriented direction of the fibres to run parallel to the longitudinal axis of the cylinder, i.e. in the axial direction.

For cylinders which are mounted on an air roller, for example for flexographic printing, the oriented direction of the
20 fibres is preferably perpendicular to the longitudinal axis of the cylinder.

According to another embodiment of the printing forme according to the invention, the cylinder comprises a first layer having fibres in a first oriented direction of the fibres, and a
25 second layer having fibres in a second oriented direction of the fibres, the first and second directions of the fibres not being identical. As has already been stated, the separate layers having unidirectional fibres may have a high fibre content (compare a fibre content of 63% by volume for a unidirectional
30 carbon fibre in epoxy resin with a fibre content of approximately 35% by volume for a nonwoven in epoxy resin), which is of benefit to the elastic properties. The fibre content of the cylinder according to the invention is preferably greater than 45% by volume. A cylinder of this type according to the
35 invention is composed of at least two layers of fibre-reinforced plastic, of which the fibres in a layer are oriented in one direction and the directions of the fibres do not run parallel to one another.

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Preferably, the oriented direction of the fibres of the first layer forms an angle α with the longitudinal axis of the cylinder, and the oriented direction of the fibres of the second layer forms an angle $-\alpha$ with the longitudinal axis of the printing forme. The cylinder advantageously also comprises a further layer having fibres in a third oriented direction of the fibres, the direction of the fibres of which further layer runs parallel or perpendicular to the longitudinal axis of the cylinder. More preferably, this further layer is arranged between the first and second layers.

Examples of the angle α are 0° , 30° , 45° and angles of $> 60^\circ$. A three-layer laminate for use in the cylinder according to the invention therefore comprises 3 layers with differently oriented directions of the fibres of, for example, 0° and $\pm 60^\circ$ or 0° and $\pm 45^\circ$ or 0° and 90° (x2) with respect to the longitudinal axis of the cylinder, if the cylinder is a preform for a printing forme for rotary screen printing. A three-layer laminate for use in the cylinder according to the invention as a so-called "sleeve" for flexographic printing therefore comprises 3 layers with differently oriented directions of the fibres of, for example, 90° and $\pm 30^\circ$ or 90° and $\pm 45^\circ$ or 0° (x2) and 90° with respect to the longitudinal axis of the cylinder.

According to another embodiment of the cylinder according to the invention, the first layers having a first oriented direction of the fibres and second layers having a second oriented direction of the fibres alternate with one another. One example of an embodiment of this nature is a cylinder which is made from a 4-layer laminate, with the oriented direction of the fibres of the first and third layers and of the second and fourth layers being identical.

According to a particularly preferred embodiment, the cylinder is of symmetrical structure in the thickness direction, and the oriented direction of the fibres of outermost, first layers forms an angle α with the longitudinal axis of the cylinder, and the oriented direction of the fibres of second, intermediate layers forms an angle $-\alpha$ with the longitudinal axis of the cylinder. In this embodiment too, the cylinder advantageously comprises a further layer having fibres in a third oriented direction of the fibres, which direction of the

fibres runs parallel or perpendicular to the longitudinal axis of the printing forme. Just as in the cylinder comprising 3 layers which has been discussed above, the further layer is preferably arranged between the second, intermediate layers, 5 i.e. in the centre as seen in the thickness direction of the cylinder wall.

In the multilayer laminates described above, which are used to make the cylinder according to the invention and which comprise a further layer having fibres in an oriented direction 10 of the fibres which is parallel or perpendicular to the longitudinal axis of the cylinder, the thickness of this further layer is advantageously greater than the thickness of the other layers. In this case, the layers with an identically oriented direction of the fibres generally have an identical layer 15 thickness.

Depending on the thickness (diameter) of the fibres and the desired final thickness of the cylinder according to the invention, this cylinder may also comprise a plurality of adjacent layers with the same direction of the fibres.

20 If a rotary screen-printing forme is produced from the cylinder according to the invention, the total wall thickness is preferably in the range from 80-300 micrometers. A small thickness of this nature also allows printing openings to be made using a laser, in accordance with a design which is to be 25 printed. If the cylinder according to the invention is used as a flexographic printing sleeve, the minimum wall thickness is approximately 0.08 mm. For label printing the total wall thickness is advantageously in the range from 0.02 to 0.15 mm.

The thin-walled cylinder according to the invention are 30 easily machined by a laser, for example to manufacture a printing forme for screen printing. It should be noted that from such a further processed cylinder it is easy to manufacture a flat printing forme by cutting the cylinder in the longitudinal direction and mounting the flat screen thus made onto a suitable 35 planar frame.

The mechanical properties of a printing forme for rotary screen printing which is made from a cylinder according to the invention are also good.

The oriented directions of the fibres, layer thicknesses and material can be varied, although there are preferred directions and materials, depending on the final application as has already been stated above and will be illustrated in more detail below.

If desired, in the cylinder according to the invention, it is possible for the material layers to be combined to form a quasi-isotropic laminate, in order to reduce the anisotropy of a single layer having unidirectional fibres.

As has already been stated above, it is possible for the fibre materials and the plastics of the binder matrix to be selected as a function of the desired properties. Examples of suitable fibre materials include carbon fibres, inorganic fibres such as glass fibres and boron fibres, metal fibres and organic plastic fibres, such as stretched fibres, for example aramid fibres and fibres of high-strength stretched polyethylene, as well as combinations thereof. The carbon fibres and inorganic fibres are particularly preferred, and of these carbon fibres are most preferred. The binder material used is not critical, since it makes little contribution to the mechanical properties compared to the fibres, and may be selected from the known thermoplastics, such as polyesters and thermosetting plastics, such as epoxy resins. Of customary combinations, carbon/epoxy is preferred, on account of the excellent relationship between cost price and rigidity. The rigidity of this combination is virtually twice as great as that of kevlar/epoxy and three times as great as that of glass/epoxy. Other combinations with a still higher rigidity include carbon/polyimide, graphite/epoxy and silicon carbide/ceramic. However, these combinations are expensive. The abovementioned single-layer materials are commercially available.

The elastic parameters for a number of fibre/binder matrix single-layer combinations are described, inter alia, in "Engineering Mechanics of Composite Materials", I.M. Daniel et al., Oxford University Press, 1994, and are compiled below in Table 1.

Table 1

	Fibre	E modulus	E modulus	Sliding	Poisson's
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	content (% by volume)	// fibres (GPa)	⊥ fibres (GPa)	modulus (GPa)	ratio
E-glass/ Epoxy	55	39	8.6	3.8	0.28
S-glass/ Epoxy	50	43	8.9	4.5	0.27
Kevlar/ Epoxy	60	87	5.5	2.2	0.34
Carbon/ PEEK	58	131	8.7	5.0	0.28
Carbon/ Epoxy	63	142	10.3	7.2	0.27
Carbon/ Polyimide	45	216	5.0	4.5	0.25
Graphite/ Epoxy	57	294	6.4	4.9	0.23
Silicon Carbide/ Ceramic	39	121	112	44	0.20

The elastic parameters for quasi-isotropic laminates are given in table 2 below.

Table 2

5

	E modulus (GPa)	Sliding modulus (GPa)	Poisson's ratio
E-glass/Epoxy	18.9	7.3	0.29
S-glass/Epoxy	20.9	8.2	0.27
Kevlar/Epoxy	32.6	12.3	0.33
Carbon/PEEK	50.7	19.4	0.30
Carbon/Epoxy	56.7	22.1	0.29
Carbon/Polyimide	77.4	29.6	0.31
Graphite/Epoxy	104	39.7	0.31
Silicon carbide/ Ceramic	113	46.4	0.22

The materials from which the layers are made may, in addition to the abovementioned binders and unidirectional fibres, also contain other conventional additives, such as lubricants, adhesion-promoting agents, fillers, pigments and the like, if desired.

10

Furthermore, if desired, the printing forme according to the invention may be provided with one or more additional surface layers which do not contain any fibres and have desired properties, in particular plastics layers, on the inside and/or outside of the cylinder. Examples of desired properties of this nature include, inter alia, reduced friction (polytetrafluoro-

15

ethylene), wear resistance, scratch resistance, hydrophobic nature and strength.

The invention also relates to the use of a cylinder according to the invention as a preform for the production of a printing forme for rotary screen printing, as a sleeve for flexographic and offset printing, which is to be mounted on an air roller, as a printing forme for gravure printing, as a transfer medium for transferring coatings and inks, as an electroforming mould or as a coating material.

The invention is explained below with reference to the appended drawing, in which:

Fig. 1 shows a perspective, diagrammatic view of a printing forme for rotary screen printing which is produced from a cylinder according to the invention;

Fig. 2 shows a diagrammatic view of a fibre-reinforced plastics layer having an oriented direction of the fibres;

Fig. 3 shows an exploded, diagrammatic view of a symmetrical 3-layer laminate; and

Fig. 4 shows an exploded, diagrammatic view of a 5-layer laminate.

Fig. 1 illustrates a rotary screen-printing forme 10 which is made from a thin hollow cylinder 12 according to the invention. Perforations are made in this cylinder in accordance with a design to be printed using high-energy radiation, such as a CO₂ laser. In this case, these perforations form printing openings 14 which define images 16 and 18 which are to be printed. The total thickness d^{tot} of the cylinder wall is, for example, 140 μm for a diameter D of 203.4 mm and a length L of 1850 mm.

Fig. 2 shows a planar fibre-reinforced plastics layer 20 having fibres 22 (diagrammatically indicated by relatively thin, continuous lines), of which the oriented direction of the fibres runs parallel to the longitudinal axis of a cylinder which is to be made from this layer. This axial direction of the fibres is advantageous for reducing the total bending of the printing forme 10.

For the sake of simplicity, in the following figures identical components are denoted by identical reference numerals.

Fig. 3 diagrammatically depicts a 3-layer laminate 30, in which the middle layer 32 with a thickness of 84 μm consists of the fibre-reinforced plastics layer shown in Fig. 2, i.e. the fibres 22 run parallel to the longitudinal axis (not shown in Fig. 3). On both sides of the middle layer 32 there is an outermost layer 34 with a thickness of 28 μm , the fibres 22 of which have an orientation which is perpendicular to the longitudinal axis. A laminate with unidirectional fibres of this nature may, for example, be formed by means of customary techniques, such as pultrusion, injection-moulding, lamination and winding, and may be machined, if necessary, by grinding, polishing and the like. However, in most cases further machining of this nature is superfluous. A suitable method for preparing a cylinder according to the invention is disclosed in US-A-5 071 506. In this method a composite material is applied on a mandrel having an inflatable bladder. The mandrel is inserted into a single press mould. Upon pressurizing the inflatable bladder the composite material is forced against the wall of the mould. Subsequently the composite material is cured.

A laminate in which the central layer has an oriented direction of the fibres which is perpendicular to the longitudinal axis and the oriented directions of the fibres of the outer layers form an angle α , where α is not 90° , and α is preferably 0° , is used as a base structure for the production of a cylinder according to the invention which is supported during use (for example a sleeve for flexographic printing), since in this case less bending can occur but the properties in the tangential direction are of importance.

Fig. 4 shows a diagram illustrating the layer structure of an example of a 5-layer laminate 40 according to the invention in planar form. The laminate 40 with a symmetrical structure comprises a middle layer 32 with a thickness of 200 μm , in which fibres 22 are oriented in the longitudinal direction of the cylinder which is to be made from this laminate. On either side of the middle layer 32 there are two intermediate layers 44 with a layer thickness of 20 μm , of which the direction of the fibres forms an angle $\alpha = 70^\circ$ with respect to the longitudinal axis. The outermost, first layers 46 likewise with a thickness of 10 μm have fibres 22 with an

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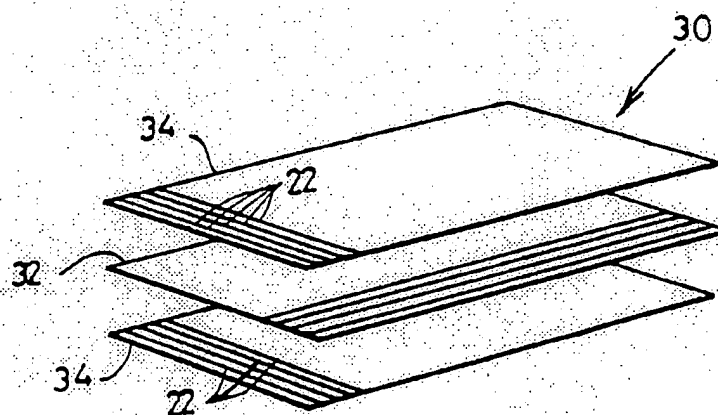
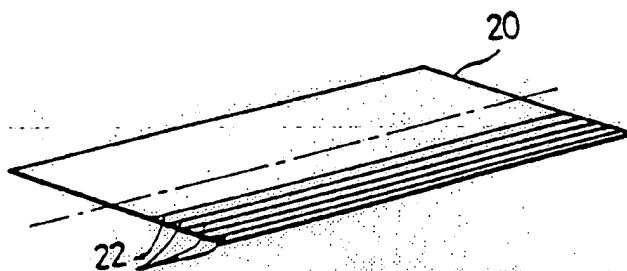
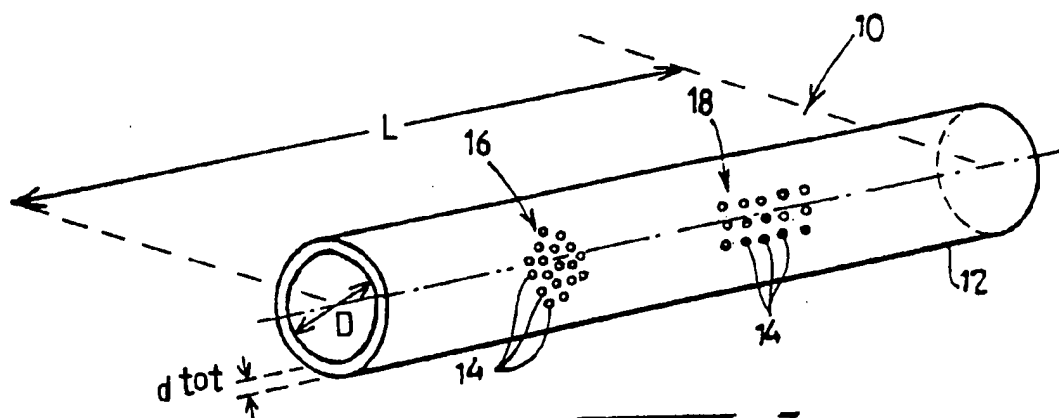
orientation of $+70^\circ$ with respect to the longitudinal axis. A cylinder with a diameter of 120 mm is produced from this 5-layer laminate.

5 It should be noted that in practice the selection of a specific direction of the fibres will be partially determined by the reproducibility of the production technique employed and the total costs.

CLAIMS

1. Thin-walled hollow cylinder (12) made from fibre-reinforced plastics material, comprising at least one layer (20; 32, 34; 32, 44, 46) having fibres (22) with at least one oriented direction of the fibres, the total wall thickness d^{tot} lying in the range from 0.010 to 1 mm, and the ratio d^{tot}/D being ≤ 0.0025 , where D is the diameter (in mm) of the cylinder.
- 10 2. Cylinder according to claim 1, characterized in that the total wall thickness is in the range from 0.010 to 0.700 mm.
3. Cylinder according to claim 2, characterized in that the total wall thickness is in the range from 0.020 to 0.300 mm.
4. Cylinder according to one of the preceding claims ,
- 15 characterized in that the cylinder (12) comprises a fibre-reinforced layer having fibres with two oriented directions of the fibres.
5. Cylinder according to one of the preceding claims, characterized in that an oriented fibre direction lies parallel
- 20 or perpendicular to the longitudinal axis of the cylinder (12).
6. Cylinder according to one of the preceding claims 1-3, characterized in that the cylinder (12) comprises a first layer having fibres in a first oriented direction of the fibres, and a second layer having fibres in a second oriented direction of the
- 25 fibres, the oriented directions of the fibres not being identical.
7. Cylinder according to claim 6, characterized in that the oriented direction of the fibres of the first layer forms an angle α with the longitudinal axis of the cylinder (10), and the
- 30 oriented direction of the fibres of the second layer forms an angle $-\alpha$ with the longitudinal axis of the cylinder (12).
8. Cylinder according to one of the preceding claims 6 or 7, characterized in that the cylinder (12) also comprises a further layer (32) having fibres (22) in a third oriented
- 35 direction of the fibres, the direction of the fibres running parallel or perpendicular to the longitudinal axis of the cylinder (12).

9. Cylinder according to claim 86, characterized in that the said further layer (32) is present between the first layer (34) and the second layer (34).
10. Cylinder according to one of the preceding claims 6 or 7, characterized in that first layers having a first oriented direction of the fibres and second layers having a second oriented direction of the fibres alternate with one another.
11. Cylinder according to one of the preceding claims 1-3, characterized in that the cylinder (12) is of symmetrical structure in the thickness direction, and the oriented direction of the fibres of outermost, first layers (46) forms an angle α with the longitudinal axis of the cylinder (12), and the oriented direction of second, intermediate layers (44) forms an angle $-\alpha$ with the longitudinal axis of the cylinder (12).
12. Cylinder according to claim 11, characterized in that the cylinder comprises a further layer (32) having fibres (22) in a third oriented direction of the fibres, which direction of the fibres runs parallel or perpendicular to the longitudinal axis of the cylinder (12).
13. Cylinder according to claim 12, characterized in that the further layer (32) is arranged between the second, intermediate layers (44).
14. Cylinder according to one of claims 8-9 or 11-13, characterized in that the layer thickness of the outermost, first layers (46) is identical.
15. Cylinder according to one of claims 8-9 or 12-13, characterized in that the thickness of the further layer (32) is greater than the thickness of the other layers (34, 44, 46).
16. Cylinder according to one of the preceding claims, characterized in that the fibre-reinforced plastics material consists of unidirectional carbon fibres in an epoxy matrix.
17. Cylinder according to one of the preceding claims 1-3, characterized in that the cylinder (12) is made from a quasi-isotropic laminate.
18. Cylinder according to one of the preceding claims, characterized in that a surface layer which does not contain any fibres is provided on the inside and/or outside of the cylinder (12).



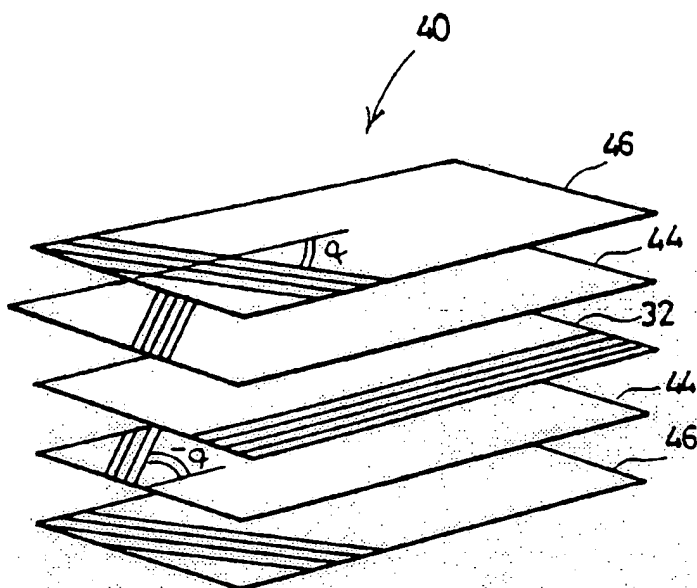


FIG. 4.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/NL 00/00747

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F16L9/12 F16L11/04 B32B1/08 B32B5/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B41N B32B B41C B29C F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

WPI Data, EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 981 237 A (RHODES JOHN M) 21 September 1976 (1976-09-21) cited in the application column 6, line 62 -column 8, line 10 column 9, line 41 -column 10, line 15 ---	1,2,17, 19,20
X	US 5 087 946 A (DALAL EDUL N ET AL) 11 February 1992 (1992-02-11) column 4, line 62 -column 6, line 27; figures 4,5 --- -/--	1,2, 16-19

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
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- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- *Z* document member of the same patent family

Date of the actual completion of the international search

8 February 2001

Date of mailing of the international search report

19/02/2001

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel: (+31-70) 340-2040, Tx. 31 651-epo nl
Fax: (+31-70) 340-3016

Authorized officer

Balsters, E

INTERNATIONAL SEARCH REPORT

International Application No
PCT/NL 00/00747

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DATABASE WPI Section Ch, Week 200003 Derwent Publications Ltd., London, GB; Class A35, AN 2000-026697 XP002141954 & JP 11 278817 A (NIPPON CARBON CO LTD), 12 October 1999 (1999-10-12) cited in the application	1,16
A	abstract	4-15, 17-20
A	US 4 214 932 A (VAN AUKEN RICHARD L) 29 July 1980 (1980-07-29) column 2, line 14 - line 54; figures 1,5	1-20
A	US 4 165 765 A (GILBU AGNAR ET AL) 28 August 1979 (1979-08-28) column 1, line 49 -column 3, line 66; figures 1,3	1-20
A	US 3 684 605 A (ZWART HANS H J) 15 August 1972 (1972-08-15) the whole document	1-20

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/NL 00/00747

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3981237 A	21-09-1976	NONE	
US 5087946 A	11-02-1992	JP 4232983 A	21-08-1992
JP 11278817 A	12-10-1999	NONE	
US 4214932 A	29-07-1980	NONE	
US 4165765 A	28-08-1979	NONE	
US 3684605 A	15-08-1972	NONE	

EP&C

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P A T E N T S
T R A D E M A R K S
D E S I G N S

FACSIMILE 070 3 40 30 16
CONFIRMATION BY MAIL
EUROPEAN PATENT OFFICE
Postbus 5818
2280 HV RIJSWIJK(ZH)

Rijswijk, 9 September 2002

Your ref. :
Our ref. : A00-40084/JV/NBR

Application no. : 00975000.1
Country : Europe
In the name of : Stork Screens B.V.
Title : Composite sleeve II

EPA EPO-OEB DG 1 Requ:	
09.09.2002	
11	ANL ZEICHN

Dear Sirs,

In reply to your Communication dated August 6, 2002 pursuant to Rules 109 and 110 EPC the following comments to US-A-3 981 237 are filed. Hereinafter this document will be identified by the abbreviation D1.

The only paragraph, where fibers are mentioned in document D1, is column 9, lines 54-55. In this paragraph a method is disclosed in order to produce a seamless blank by using conventional techniques (line 43). More specifically a two step extrusion process is proposed (line 46). It appears from lines 43-46 that the existing extrusion techniques are not sufficiently accurate, in particular regarding dimensions and tolerances. In this two step extrusion process first a cylindrical blank is produced using conventional extrusion techniques (line 50) from a thermoplastic material, which optionally may be filled with a reinforcing material such as glass fibers (line 55). The second step is a biaxial drawing operation in which both radial and longitudinal dimensions are increased by 2 to 5 times thereby producing a seamless cylinder having the desired dimensions (line 58). This means that the wall thickness of the tubular blank must be the product of

the radial and longitudinal draw ratios, i.e. given the range of draw ratios, from 4 to 25 times the final desired cylinder wall thickness.

From this paragraph it is evident that no long fibers can be used in this method according to D1. The reasons therefor comprise:

1. In conventional extrusion technique it is not possible to use long unidirectional fibers as a reinforcing material in a cylindrical blank. If one would like to do so, he is obliged to use special techniques, for example pultrusion, which is a completely different technology. If one uses thermoplastic materials (instead of resins) conventional extrusion is very difficult, if possible at all, and requires completely different equipment and knowledge. And if possible, the fibers would run in the longitudinal direction only.
2. Even if one would obtain a blank having unidirectional fibers, biaxial drawing or stretching thereof would be impossible. According to the method disclosed in D1 the blank is mounted inside a pressure vessel, and situated such that one end enters an annular slit between a die and an expanding mandrel. Column 10, line 1-4. The expandable mandrel has to expand in such a way that the material, from which the cylindrical blank has been made, is forced into the annular slit between the die and the expanding mandrel and the material starts to flow, such that both the diameter as well as the length increases 2 to 5 times. However, using this technique it is unpredictable what will occur to the fibers. In particular where they would be present in the final product. The distribution of the fibers and thereby the mechanical properties will vary from place to place, and from product to product. This is also valid for the wall thickness, if one recognizes that the fibers can be only pressed upon each other until they contact each other. As a result thereof differences in opening dimensions will occur during engraving with the aid of a laser, also because of the differences between (carbon) fibers and the thermoplastic matrix material in view of machining by a laser.

In summary when the method according to D1 would be carried out with long unidirectional fibers the properties of the final product would vary in an unacceptable way. This cannot have been the purpose of Rhodes' invention.

The method according to D1 could probably be possible with chopped fibers, although it would have been difficult with these type of fibers as well, in particular the biaxial drawing of the tubular blank. However, chopped fibers, which are randomly distributed in the plastic matrix, cannot be piled up close together as unidirectional fibers in a prepreg process, during which the fibers are laid down together as close as possible.

In manufacturing screens or stencils from plastic material the deformation is a critical factor. In the examples of D1 the modulus of elasticity is 3.5 GPa, which corresponds to the stiffness, which is the maximum for plastics like polyesters without fibers. The modulus of elasticity for nickel is approximately 170 GPa, which is 50 times higher. In view thereof the present stencils or screens made from nickel cannot be replaced by stencils or screens which are manufactured from unfilled plastic materials. Only the use of long unidirectional fibers, such as carbon fibers, which are grouped in optimal directions and being present in a high fiber content, can offer a solution. The presence and orientation of the fibers is therefore critical and is the core of present invention.

In D1 use is made of thermoplastic materials, in particular in the form of sheets, which are sealed or adhered together, or are made seamless using other techniques. In the present invention use is made of prepreg tapes having unidirectional fibers, which are laid down as close as possible in these prepreg tapes.

As already described above conventional extrusion techniques could only be used in thermoplastics having chopped fibers, if it is possible at all, because the subsequent biaxial stretching can only be carried out with blanks having chopped fibers. Longer or continuous fibers would break during biaxial drawing.

- 4 -

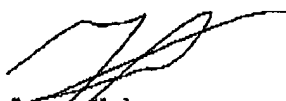
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As already stated hereinabove, the modulus of elasticity in the examples of D1 is 3.5 GPa, while a conventional screen made from nickel shows a modulus of elasticity of 180 GPa. In order to achieve the same stiffness the wall thickness of a screen made from plastic material should have been increased 51 times, however according to D1 an increase of only 3 times is allowed in view of printing.

The present European patent application has entered the regional phase with the claims as originally filed and not with the claims as amended during the International Preliminary Examination phase. The limitation with respect to the fiber content in claim 1, which has been introduced during this international phase, is in view of the above comments on document D1 unnecessary.

It is believed that the above comments will take away any objection raised by the Examiner according to the First Written Opinion during the international phase.


The representative,


Johan Volmer

Dossier: 00975000

1004	2002-04-03	pp-1-1	General authorisation
1200	2002-04-03	pp-1-5	Request to enter regional phase (EPCT)
INCANNEX	2002-04-03	pp-1-5	Incoming annex that cannot be clearly identified
ABEX	2002-04-03	pp-1-1	Amendments before examination
INCANNEX	2002-04-03	pp-1-4	Incoming annex that cannot be clearly identified
CLMS	2002-04-03	pp-1-3	Claims
IPERAMD	2002-02-14	pp-1-1	Amendments attached to the international preliminary examination report
IPER	2002-02-14	pp-1-4	Copy of the International preliminary examination report

VOLLMACHT / AUTHORISATION / POUVOIR

<p>Zeichen des Vertreters (der Vertreter)/ Representative's reference / Référence du (des) mandataire(s) (max. 15 Positionen / max 15 spaces /15 caractères au maximum)</p> <p>A00-40084/JV</p>	<p>Anmelde / Patent Nr. Application / Patent No. Demande / Brevet No.</p>
<p>Ich (Wir)/I (We)/Je (Nous)</p> <p>Stork Screens B.V. 3, Raamstraat 5861 AT BOXMEER The Netherlands</p>	
<p>bevollmächtigte(n) hiermit/do hereby authorise/autorise (autorisons) par la présente</p> <p>Drs F. Barendregt, Ir J.A. Iemenschot, Ir G.H. Boelsma, Ir H.V. Mertens, Ir C.H.J. Timmers, Ir J.A. van der Veken, Drs J.H. Mommaerts, Drs G.W.F. van der Kloet-Dorleijn, Ir A.G.A. van der Arend, Ir H.J.A. Brookhuis, Ir J.C. Volmer, Ir R.H. Riemens, Dr T.H. Wittop Koning (Patent Attorneys) and Mr J.M.L.F. Keijser (Lawyer)</p>	
<p><input type="checkbox"/> Weitere Vertreter sind auf einem gesonderten Blatt angegeben./Additional representatives indicated on supplementary sheet./ D'autres mandataires sont mentionnés sur une feuille supplémentaire.</p>	
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<p>Ort/Place/Lieu</p> <p>Boxmeer</p>	<p>Datum/Date</p> <p>14 March 2002</p>
<p>Unterschrift(en)/Signature(s).</p> <p>Stork Screens B.V.</p> <p style="text-align: center;"></p>	
<p>KERCKDIJK, Cornelis Bertus Wilhelmus (General Patent Manager)</p>	

**An das Europäische Patentamt**

Nur für ab 1. Juli 1999 eingereichte internationale Anmeldungen!

To the European Patent Office

Only for international applications filed from 1 July 1999 onwards!

A l'Office européen des brevets 1

Seulement pour les demandes internationales déposées à compter du 1^{er} juillet 1999!

**Eintritt in die europäische Phase
(EPA als Bestimmungsamt oder ausgewähltes Amt)****Entry into the European phase
(EPO as designated or elected Office)****Entrée dans la phase européenne
(l'OEB agissant en qualité d'office désigné ou élu)**

Europäische Anmeldenummer oder, falls nicht bekannt, PCT-Aktenzeichen oder PCT-Veröffentlichungsnummer	European application number, or, if not known, PCT application or publication number	Numéro de dépôt de la demande de brevet européen ou, à défaut, numéro de dépôt PCT ou de publication PCT
00975000.1	00975000.1	
Zeichen des Anmelders oder Vertreters (max. 15 Positionen)	Applicant's or representative's reference (max. 15 spaces)	Référence du demandeur ou du mandataire (15 caractères ou espaces au maximum)
A00-40084/JV	A00-40084/JV	
<input checked="" type="checkbox"/> 1. Anmelder Die Angaben über den (die) Anmelder sind in der internationalen Veröffentlichung enthalten oder vom internationalen Büro nach der internationalen Veröffentlichung vermerkt worden. <input type="checkbox"/> Änderungen, die das Internationale Büro noch nicht vermerkt hat, sind auf einem Zusatzblatt angegeben. Zustellanschrift (siehe Merkblatt II, 1)	1. Applicant Indications concerning the applicant(s) are contained in the international publication or recorded by the International Bureau after the international publication. Changes which have not yet been recorded by the International Bureau are set out on an additional sheet. Address for correspondence (see Notice II, 1) ZUR KASSE EUR 2.070,00	1. Demandeur Les indications concernant le(s) demandeur(s) figurent dans la publication internationale ou ont été enregistrées par le Bureau international après la publication internationale. Les changements qui n'ont pas encore été enregistrés par le Bureau international sont indiqués sur une feuille additionnelle. Adresse pour la correspondance (voir notice II, 1)
2. Vertreter Name (Nur einen Vertreter angeben, der in das europäische Patentregister eingetragen und an den zugestellt wird) Geschäftsanschrift EPO - DG 1 03.06.2002 Telefon Telefax <input type="checkbox"/> Weitere(r) Vertreter auf Zusatzblatt	Representative Name (Name only one representative who will be listed in the Register of European Patents and to whom notification will be made) VOLMER, J.C. Address of place of business Exter Polak & Charlois B.V. P.O. Box 3241 2280 GE RIJSWIJK The Netherlands Telephone 070 - 4145454 Fax 070 - 4145499 Additional representative(s) on additional sheet	2. Mandataire Nom (N'indiquer qu'un seul mandataire, qui sera inscrit au Registre européen des brevets et auquel signification sera faite) Adresse professionnelle Téléphone Téléfax Autre(s) mandataire(s) sur une feuille additionnelle
3. Vollmacht <input checked="" type="checkbox"/> Einzelvollmacht ist beigelegt. <input type="checkbox"/> Allgemeine Vollmacht ist registriert unter Nummer: <input type="checkbox"/> Allgemeine Vollmacht ist eingereicht, aber noch nicht registriert. <input type="checkbox"/> Die beim EPA als PCT-Anmeldeamt eingereichte Vollmacht schließt ausdrücklich die europäische Phase ein.	3. Authorisation Individual authorisation is attached. General authorisation has been registered under No: A general authorisation has been filed, but not yet registered. The authorisation filed with the EPO as PCT receiving Office expressly includes the European phase.	3. Pouvoir Un pouvoir spécial est joint. Un pouvoir général a été enregistré sous le n°: Un pouvoir général a été déposé, mais n'est pas encore enregistré. Le pouvoir général déposé à l'OEB agissant en qualité d'office récepteur au titre du PCT s'applique expressément à la phase européenne.

<p><input checked="" type="checkbox"/> 4. Prüfungsantrag Hiermit wird die Prüfung der Anmeldung gemäß Art. 94 EPU beantragt. Die Prüfungsgebühr wird (wurde) entrichtet.</p> <p>Prüfungsantrag in einer zugelassenen Nichtamtssprache (siehe Merkblatt III, 5.2) :</p>	<p>4. Request for examination Examination of the application under Art. 94 EPC is hereby requested. The examination fee is being (has been, will be) paid.</p> <p>Request for examination in an admissible non-EPO language (see Notes III, 5.2) :</p> <p>Verzoekt wordt om onderzoek van de aanvraag zoals bedoeld in Art.94.</p>	<p>4. Requête en examen Il est demandé que soit examinée la demande de brevet conformément à l'art. 94 CBE. Il est (a été, sera) procédé au paiement de la taxe d'examen.</p> <p>Requête en examen dans une langue non officielle autorisée (voir notice III, 5.2) :</p>
<p><input type="checkbox"/> 5. Abschriften Zusätzliche Abschrift(en) der im ergänzenden europäischen Recherchenbericht angeführten Schriftstücke wird (werden) beantragt.</p> <p>Anzahl der zusätzlichen Sätze von Abschriften</p>	<p>5. Copies Additional copy (copies) of the documents cited in the supplementary European search report is (are) requested.</p> <p>Number of additional sets of copies</p>	<p>5. Copies Prière de fournir une ou plusieurs copies supplémentaires des documents cités dans le rapport complémentaire de recherche européenne.</p> <p>Nombre de jeux supplémentaires de copies</p>
<p>6. Für das Verfahren vor dem EPA bestimmte Unterlagen</p> <p>6.1 Dem Verfahren vor dem EPA als Bestimmungsamt (PCT II) sind folgende Unterlagen zugrunde zu legen:</p> <p><input checked="" type="checkbox"/> die vom Internationalen Büro veröffentlichten Anmeldeunterlagen (mit allen Ansprüchen, Beschreibung und Zeichnungen), gegebenenfalls mit den geänderten Ansprüchen nach Art. 19 PCT</p> <p><input type="checkbox"/> soweit sie nicht ersetzt werden durch die beigefügten Änderungen.</p> <p><i>Falls nötig, sind Klarstellungen auf einem Zusatzblatt einzureichen!</i></p> <p>6.2 Dem Verfahren vor dem EPA als ausgewähltem Amt (PCT II) sind folgende Unterlagen zugrunde zu legen:</p> <p><input checked="" type="checkbox"/> die dem Internationalen vorläufigen Prüfungsbericht zugrunde gelegten Unterlagen, einschließlich seiner eventuellen Anlagen (Solche Anlagen müssen immer beigefügt werden)</p> <p><input checked="" type="checkbox"/> soweit sie nicht ersetzt werden durch die beigefügten Änderungen.</p> <p><i>Falls nötig, sind Klarstellungen auf einem Zusatzblatt einzureichen!</i></p> <p><input checked="" type="checkbox"/> Sind dem EPA als mit der internationalen vorläufigen Prüfung beauftragten Behörde Versuchsberichte zugegangen, dürfen diese dem Verfahren vor dem EPA zugrunde gelegt werden.</p>	<p>6. Documents intended for proceedings before the EPO</p> <p>6.1 Proceedings before the EPO as designated Office (PCT II) are to be based on the following documents:</p> <p>the application documents published by the International Bureau (with all claims, description and drawings), where applicable with amended claims under Art. 19 PCT</p> <p>unless replaced by the amendments enclosed.</p> <p><i>Where necessary, clarifications must be submitted on a separate sheet!</i></p> <p>6.2 Proceedings before the EPO as elected Office (PCT II) are to be based on the following documents:</p> <p>the documents on which the International preliminary examination report is based, including its possible annexes (Such annexes must always be filed)</p> <p>unless replaced by the amendments enclosed.</p> <p><i>Where necessary, clarifications must be submitted on a separate sheet!</i></p> <p>If the EPO as International Preliminary Examining Authority has received test reports, these may be used as the basis of proceedings before the EPO.</p>	<p>6. Pièces destinées à la procédure devant l'OEB</p> <p>6.1 La procédure devant l'OEB agissant en qualité d'office désigné (PCT II) doit se fonder sur les pièces suivantes :</p> <p>les pièces de la demande publiée par le Bureau international (avec toutes les revendications, la description et les dessins), éventuellement avec les revendications modifiées conformément à l'article 19 du PCT</p> <p>dans la mesure où elles ne sont pas remplacées par les modifications jointes.</p> <p><i>Le cas échéant, des explications doivent être jointes sur une feuille additionnelle!</i></p> <p>6.2 La procédure devant l'OEB agissant en qualité d'office élu (PCT II) doit se fonder sur les pièces suivantes :</p> <p>les pièces sur lesquelles se fonde le rapport d'examen préliminaire international, y compris ses annexes éventuelles (De telles annexes sont toujours à joindre)</p> <p>dans la mesure où elles ne sont pas remplacées par les modifications jointes.</p> <p><i>Le cas échéant, des explications doivent être jointes sur une feuille additionnelle!</i></p> <p>Si l'OEB, agissant en qualité d'administration chargée de l'examen préliminaire international, a reçu des rapports d'essais, ceux-ci peuvent constituer la base de la procédure devant l'OEB.</p>

<p>7. Übersetzungen Beigefügt sind die nachfolgend angekreuzten Übersetzungen in einer der Amtssprachen des EPA (Deutsch, Englisch, Französisch):</p> <ul style="list-style-type: none"> <input type="checkbox"/> Im Verfahren vor dem EPA als Bestimmungsamt oder ausgewähltem Amt (PCT I + II): <input type="checkbox"/> Übersetzung der ursprünglich eingereichten internationalen Anmeldung (Beschreibung, Ansprüche, etwaige Textbestandteile in den Zeichnungen), der veröffentlichten Zusammenfassung, und etwaiger Angaben über biologisches Material nach Regel 13^{ter}.3 und 13^{ter}.4 PCT <input checked="" type="checkbox"/> Übersetzung der prioritätsbegründenden Anmeldung(en) <input type="checkbox"/> Es wird hiermit erklärt, daß die internationale Anmeldung in ihrer ursprünglich eingereichten Fassung eine vollständige Übersetzung der früheren Anmeldung ist (Regel 38(5) EPÜ) <input type="checkbox"/> Zusätzlich im Verfahren vor dem EPA als Bestimmungsamt (PCT II): <input type="checkbox"/> Übersetzung der nach Art. 19 PCT geänderten Ansprüche nebst Erklärung, falls diese dem Verfahren vor dem EPA zugrunde gelegt werden sollen (siehe Feld 6) <input type="checkbox"/> Zusätzlich im Verfahren vor dem EPA als ausgewähltem Amt (PCT II): <input type="checkbox"/> Übersetzung der Anlagen zum internationalen vorläufigen Prüfungsbericht 	<p>7. Translations Translations in one of the official languages of the EPO (English, French, German) are enclosed as crossed below:</p> <ul style="list-style-type: none"> <input type="checkbox"/> In proceedings before the EPO as designated or elected Office (PCT I + II): Translation of the international application (description, claims, any text in the drawings) as originally filed, of the abstract as published and of any indication under Rule 13^{ter}.3 and 13^{ter}.4 PCT regarding biological material <input type="checkbox"/> Translation of the priority application(s) It is hereby declared that the international application as originally filed is a complete translation of the previous application (Rule 38(5) EPC) <input type="checkbox"/> In addition, in proceedings before the EPO as designated Office (PCT II): Translation of amended claims and any statement under Art. 19 PCT, if the claims as amended are to form the basis for the proceedings before the EPO (see Section 6) <input type="checkbox"/> In addition, in proceedings before the EPO as elected Office (PCT II): Translation of any annexes to the international preliminary examination report 	<p>7. Traductions Vous trouverez, ci-joint, les traductions cochées ci-après dans l'une des langues officielles de l'OEB (allemand, anglais, français) :</p> <ul style="list-style-type: none"> <input type="checkbox"/> Dans la procédure devant l'OEB agissant en qualité d'office désigné ou élu (PCT I + II): Traduction de la demande internationale telle que déposée initialement (description, revendications, textes figurant éventuellement dans les dessins), de l'abrégé publié, et de toutes indications visées aux règles 13^{ter}.3 et 13^{ter}.4 du PCT concernant le matériel biologique <input type="checkbox"/> Traduction de la (des) demande(s) ouvrant le droit de priorité Il est déclaré par la présente que la demande internationale telle que déposée initialement est une traduction intégrale de la demande antérieure (règle 38(5) CBE) <input type="checkbox"/> De plus, dans la procédure devant l'OEB agissant en qualité d'office désigné (PCT II) : Traduction des revendications modifiées et de la déclaration faite conformément à l'article 19 du PCT, si la procédure devant l'OEB doit être fondée sur les revendications modifiées (voir la rubrique 6) <input type="checkbox"/> De plus, dans la procédure devant l'OEB agissant en qualité d'office élu (PCT II) : Traduction des annexes du rapport d'examen préliminaire international
<p><input type="checkbox"/> 8. Biologisches Material Die Erfindung bezieht sich auf bzw. verwendet biologisches Material, das nach Regel 28 EPÜ hinterlegt worden ist.</p> <p><input type="checkbox"/> Die Angaben nach Regel 28(1)c) EPÜ (falls noch nicht bekannt, die Hinterlegungsstelle und das (die) Bezugszeichen (Nummer, Symbole usw.) des Hinterlegers) sind in der internationalen Veröffentlichung oder in der gemäß Feld 7 eingereichten Übersetzung enthalten auf:</p> <p>Seite(n) / Zeile(n)</p> <hr/> <p><input type="checkbox"/> Die Empfangsbescheinigung(en) der Hinterlegungsstelle</p> <p><input type="checkbox"/> ist (sind) beigefügt</p> <p><input type="checkbox"/> wird (werden) nachgereicht</p> <p><input type="checkbox"/> Verzicht auf die Verpflichtung des Antragstellers nach Regel 28(3) auf gesondertem Schriftstück</p>	<p><input type="checkbox"/> 8. Biological material The invention relates to and/or uses biological material deposited under Rule 28 EPC.</p> <p><input type="checkbox"/> The particulars referred to in Rule 28(1)(c) EPC (if not yet known, the depository institution and the identification reference(s) [number, symbols etc.] of the depositor) are given in the international publication or in the translation submitted under Section 7 on:</p> <p>page(s) / line(s)</p> <hr/> <p><input type="checkbox"/> The receipt(s) of deposit issued by the depository institution</p> <p><input type="checkbox"/> is (are) enclosed</p> <p><input type="checkbox"/> will be filed at a later date</p> <p><input type="checkbox"/> Waiver of the right to an undertaking from the requester pursuant to Rule 28(3) attached.</p>	<p><input type="checkbox"/> 8. Matière biologique L'invention concerne et/ou utilise de la matière biologique, déposée conformément à la règle 28 CBE.</p> <p><input type="checkbox"/> Les indications visées à la règle 28(1)c) CBE (si pas encore connues, l'autorité de dépôt et la (les) référence(s) d'identification [numéro ou symboles etc.] du déposant) figurent dans la publication internationale ou dans une traduction produite conformément à la rubrique 7 à la / aux:</p> <p>page(s) / ligne(s)</p> <hr/> <p><input type="checkbox"/> Le(s) récépissé(s) de dépôt délivré(s) par l'autorité de dépôt</p> <p><input type="checkbox"/> est (sont) joint(s)</p> <p><input type="checkbox"/> sera (seront) produit(s) ultérieurement</p> <p><input type="checkbox"/> Renonciation, sur document distinct, à l'engagement du requérant au titre de la règle 28(3).</p>

<p>9. Nucleotid- und Aminosäuresequenzen Die nach Regeln 5.2 und 13^{ter} PCT sowie Regel 111(3) EPÜ erforderlichen Unterlagen liegen dem EPA bereits vor.</p> <p><input type="checkbox"/> Das schriftliche Sequenzprotokoll wird anliegend in einer Amtssprache des EPA nachgereicht.</p> <p><input type="checkbox"/> Das Sequenzprotokoll geht nicht über den Inhalt der Anmeldung in der ursprünglich eingereichten Fassung hinaus.</p> <p><input type="checkbox"/> Der vorgeschriebene Datenträger ist beigelegt.</p> <p><input type="checkbox"/> Die auf dem Datenträger gespeicherte Information stimmt mit dem schriftlichen Sequenzprotokoll überein.</p>	<p>9. Nucleotide and amino acid sequences The items necessary in accordance with Rules 5.2 and 13^{ter} PCT and Rule 111(3) EPC have already been furnished to the EPO.</p> <p>The written sequence listing is furnished herewith in an official language of the EPO.</p> <p>The sequence listing does not include matter which goes beyond the content of the application as filed.</p> <p>The prescribed data carrier is enclosed.</p> <p>The information recorded on the data carrier is identical to the written sequence listing.</p>	<p>9. Séquences de nucléotides et d'acides aminés Les pièces requises selon les règles 5.2 et 13^{ter} PCT et la règle 111(3) CBE ont déjà été déposées auprès de l'OEB.</p> <p>La liste de séquences écrite est produite ci-joint dans une des langues officielles de l'OEB.</p> <p>La liste de séquences ne contient pas d'éléments s'étendant au-delà du contenu de la demande telle qu'elle a été déposée.</p> <p>Le support de données prescrit est joint.</p> <p>L'information figurant sur le support de données est identique à celle que contient la liste de séquences écrite.</p>
<p>10. Benennungsgebühren*</p> <p><input checked="" type="checkbox"/> 10.1 Es ist derzeit beabsichtigt, den siebenfachen Betrag einer Benennungsgebühr zu entrichten. Damit gelten die Benennungsgebühren für alle Vertragsstaaten des EPÜ¹ als entrichtet (Art. 2 Nr. 3 GebO), soweit sie in der internationalen Anmeldung bestimmt sind.</p> <p><input type="checkbox"/> 10.2 Abweichend von der Erklärung in Nr. 10.1 ist derzeit beabsichtigt, weniger als sieben Benennungsgebühren für folgende in der Internationalen Anmeldung bestimmte Vertragsstaaten des EPÜ² zu entrichten:</p> <p>(1) <input type="text"/> _____</p> <p>(2) <input type="text"/> _____</p> <p>(3) <input type="text"/> _____</p>	<p>10. Designation fees*</p> <p>10.1 It is currently intended to pay seven times the amount of the designation fee. The designation fees for all the EPC contracting states¹ designated in the international application are thereby deemed to have been paid (Art. 2 No. 3 RFEes).</p> <p>10.2 The declaration in No. 10.1 does not apply. Instead, it is currently intended to pay fewer than seven designation fees for the following EPC contracting states² designated in the international application:</p> <p>(4) <input type="text"/> _____</p> <p>(5) <input type="text"/> _____</p> <p>(6) <input type="text"/> _____</p>	<p>10. Taxes de désignation*</p> <p>10.1 Il est actuellement envisagé de payer un montant correspondant à sept fois la taxe de désignation. Les taxes de désignation sont ainsi réputées payées pour tous les Etats contractants de la CBE¹ désignés dans la demande internationale (art. 2, point 3 du RRT).</p> <p>10.2 Contrairement à ce qui est indiqué au n° 10.1, il est actuellement envisagé de payer moins de sept taxes de désignation pour les Etats contractants de la CBE² suivants désignés dans la demande internationale :</p>
<p>Soweit unter Nr. 10.2 Vertragsstaaten aufgeführt sind, wird beantragt, für die dort nicht aufgeführten Vertragsstaaten von der Zustellung einer Mitteilung nach Regel 108(3) EPÜ abzusehen.</p> <p><input checked="" type="checkbox"/> 10.3 Wird ein automatischer Abbuchungsauftrag erteilt (Feld 12), so wird das EPA beauftragt, bei Ablauf der Grundfrist nach Regel 107 (1)d) EPÜ den siebenfachen Betrag einer Benennungsgebühr abzubuchen. Ist eine Erklärung nach Nr. 10.2 abgegeben worden, so sollen die Benennungsgebühren nur für die dort angegebenen Vertragsstaaten abgebucht werden, sofern dem EPA nicht bis zum Ablauf der Grundfrist ein anderslautender Auftrag zugeht.</p>	<p>If contracting states are indicated under No. 10.2, it is requested that no communication under Rule 108(3) EPC be issued for contracting states not thus indicated.</p> <p>10.3 If an automatic debit order has been issued (Section 12), the EPO is authorised, on expiry of the basic period under Rule 107(1)(d) EPC, to debit seven times the amount of the designation fee. If states are indicated under No. 10.2, the EPO will debit designation fees only for those states, unless instructed otherwise before the basic period expires.</p>	<p>Si des Etats contractants sont mentionnés au n° 10.2, prière de ne pas procéder à la signification d'une notification prévue par la règle 108(3) CBE pour les Etats contractants n'ayant pas été y mentionnés.</p> <p>10.3 Si un ordre de prélèvement automatique est donné (rubrique 12), il est demandé à l'OEB de prélever, à l'expiration du délai normal visé à la règle 107(1)d) CBE, un montant correspondant à sept fois la taxe de désignation. Si une déclaration a été faite au n° 10.2, les taxes de désignation ne sont à prélever que pour les Etats contractants qui y sont indiqués, sauf instruction contraire reçue par l'OEB avant l'expiration du délai normal.</p>
<p>* Form 1200 (01.02) nur verwenden für internationale Anmeldungen, die ab 1. Juli 1999 eingereicht worden sind.</p> <p>¹ Stand bei Drucklegung: 20 Vertragsstaaten, und zwar: / Status when this form was printed: 20 contracting states, namely / Situation à la date d'impression: 20 Etats contractants, à savoir: AT Österreich / Austria, BE Belgien / Belgium, CH/Schweiz / Switzerland, CY Zypern / Cyprus, DE Deutschland / Germany, DK Dänemark / Denmark, ES Spanien / Spain, FI Finnland / Finland, FR Frankreich / France, GB Vereinigtes Königreich / United Kingdom, GR Griechenland / Greece, IE Irland / Ireland, IT Italien / Italy, LU Luxemburg / Luxembourg, MC Monaco / Monaco, NL Niederlande / Netherlands, PT Portugal / Portugal, SE Schweden / Sweden, TR Türkei / Turkey</p> <p>² Für Türkei nur möglich, falls in der internationalen Anmeldung am oder nach dem 1. November 2000 bestimmt. / For Turkey possible only if designated in the international application on or after 1 November 2000. / En ce qui concerne la Turquie, seulement si la désignation a été effectuée dans la demande internationale le 1^{er} novembre 2000 ou à une date ultérieure.</p>	<p>* Use Form 1200 (01.02) only for international applications filed from 1 July 1999 onwards.</p>	<p>* Veuillez utiliser le formulaire 1200 (01.02) seulement pour les demandes internationales déposées à compter du 1^{er} juillet 1999.</p>

<p><input checked="" type="checkbox"/> 11. Erstreckung des europäischen Patents Diese Anmeldung gilt auch als Erstreckungsantrag für alle in der internationalen Anmeldung bestimmten Nicht-Vertragsstaaten des EPÜ, mit denen bei Einreichung der internationalen Anmeldung »Erstreckungsabkommen« in Kraft waren. Die Erstreckung wird jedoch nur wirksam, wenn die vorgeschriebene Erstreckungsgebühr entrichtet wird. Es ist derzeit beabsichtigt, die Erstreckungsgebühr für die nachfolgend angekreuzten Staaten zu entrichten:</p> <p><input checked="" type="checkbox"/> SI Slowenien <input checked="" type="checkbox"/> LT Litauen <input checked="" type="checkbox"/> LV Lettland <input type="checkbox"/> AL Albanien <input checked="" type="checkbox"/> RO Rumänien <input type="checkbox"/> MK Ehemalige jugoslawische Republik Mazedonien</p> <p>1) Platz für Staaten, mit denen »Erstreckungsabkommen« nach Drucklegung dieses Formblatts in Kraft treten und die in der internationalen Anmeldung bestimmt waren.</p>	<p>11. Extension of the European patent This application is also considered as being a request for extension to all the non-Contracting States to the EPC designated in the international application with which "extension agreements" were in force on the date of filing the international application. However, the extension only takes effect if the prescribed extension fee is paid. It is currently intended to pay the extension fee for the States marked with a cross below:</p> <p>Slovenia Lithuania Latvia Albania Romania Former Yugoslav Republic of Macedonia</p> <p>1) Space for States with which "extension agreements" enter into force after this form has been printed and which were designated in the international application.</p>	<p>11. Extension des effets du brevet européen La présente demande est également réputée demande d'extension à tous les Etats non contractants de la CBE désignés dans la demande internationale, avec lesquels existaient, lors du dépôt de la demande, des »accords d'extension«. Toutefois, l'extension ne produit ses effets que si la taxe d'extension prescrite est acquittée. Il est actuellement envisagé de payer la taxe d'extension pour les Etats dont le nom est coché ci-après:</p> <p>Slovénie Lituanie Lettonie Albanie Roumanie Ex-République yougoslave de Macédoine</p> <p>1) Prévu pour des Etats à l'égard desquels des »accords d'extension« entreraient en vigueur après l'impression du présent formulaire et qui ont été désignés dans la demande internationale.</p>
<p>12. Automatischer Abbuchungsauftrag (Nur möglich für Inhaber von beim EPA geführten laufenden Konten)</p> <p><input type="checkbox"/> Das EPA wird beauftragt, nach Maßgabe der Vorschriften über das automatische Abbuchungsverfahren fällige Gebühren und Auslagen vom untenstehenden laufenden Konto abzubuchen. In Bezug auf die Benennungsgebühren wird auf Feld 10.3 verwiesen. Das EPA wird ferner beauftragt, die Erstreckungsgebühren für jeden in Feld 11 angekreuzten »Erstreckungsstaat« bei Ablauf der Grundfrist zu ihrer Zahlung abzubuchen, sofern ihm nicht bis dahin ein anderslautender Auftrag zugeht.</p> <p>Nummer und Kontoinhaber</p>	<p>12. Automatic debit order (for EPO deposit account holders only)</p> <p>The EPO is hereby authorised, under the Arrangements for the automatic debiting procedure, to debit from the deposit account below any fees and costs falling due. For designation fees, see Section 10.3. The EPO is also authorised, on expiry of the basic period for paying the extension fees, to debit those fees for each of the "extension states" marked with a cross in Section 11, unless instructed otherwise before the said period expires.</p> <p>Number and account holder</p>	<p>12. Ordre de prélèvement automatique (uniquement possible pour les titulaires de comptes courants ouverts auprès de l'OEB)</p> <p>Par la présente, il est demandé à l'OEB de prélever du compte courant ci-dessous les taxes et frais venant à échéance, conformément à la réglementation relative au prélèvement automatique. Pour les taxes de désignation, se reporter à la rubrique 10.3. Il est en outre demandé à l'OEB de prélever, à l'expiration du délai normal prévu pour leur paiement, les taxes d'extension pour chaque »Etat autorisant l'extension« coché à la rubrique 11, sauf instruction contraire reçue avant l'expiration de ce délai.</p> <p>Numéro et titulaire du compte</p>
<p><input checked="" type="checkbox"/> 13. Eventuelle Rückzahlungen auf das beim EPA geführte laufende Konto</p> <p>Nummer und Kontoinhaber</p>	<p>13. Any reimbursement to EPO deposit account</p> <p>Number and account holder 28090031 - E P & C</p>	<p>13. Remboursements éventuels à effectuer sur le compte courant ouvert auprès de l'OEB</p> <p>Numéro et titulaire du compte</p>
<p>14. Unterschrift(en) des (der) Anmelders(s) oder Vertreters</p> <p>Ort / Datum</p> <p>Für Angestellte (Art. 133(3) EPÜ) mit allgemeiner Vollmacht:</p> <p>Nr.</p> <p>Name(n) des (der) Unterzeichneten bitte in Druckschrift wiederholen. Bei juristischen Personen bitte auch die Stellung des (der) Unterzeichneten innerhalb der Gesellschaft in Druckschrift angeben.</p>	<p>14. Signature(s) of applicant(s) or representative</p> <p>Place / Date Rijswijk, 03/04/2002</p> <p>For employees (Art. 133(3) EPC) having a general authorisation:</p> <p>No.</p> <p>Please print name(s) under signature(s). In the case of legal persons, the position of the signatory within the company should also be printed.</p>	<p>14. Signature(s) du (des) demandeur(s) ou du mandataire</p> <p>Lieu / Date</p> <p>Pour les employés (art. 133(3) CBE) disposant d'un pouvoir général:</p> <p>N°</p> <p>Le ou les noms des signataires doivent être indiqués en caractères d'imprimerie. S'il s'agit d'une personne morale, la position occupée au sein de celle-ci par le ou les signataires doit également être indiquée en caractères d'imprimerie.</p>

EP&C

EXTER POLAK & CHARLOUIS B.V.

PATENTS
TRADE MARKS
DESIGNS

EUROPEAN PATENT OFFICE
P.O. Box 5818
2280 HV RIJSWIJK (ZH)

Attn. Receiving Section

Rijswijk, April 3, 2002

Your ref. : --
Our ref. : A00-40084/JV/MKE


Application no. : 00975000.1 (based on PCT/NL00/00747)
Country : Europe
In the name of : Stork Screens B.V.

Please find enclosed:

- EPO Form 1200.
- Authorisation.
- EPO Form 1010 for payment of fees and costs.
- English translations of the basic Netherlands patent applications
Nos. 1013328 and 1013763.
- A copy of the International Preliminary Examination Report including
annexes.
- A copy of the amended claims.
- A copy of the first written opinion.

We kindly request you to execute the examination for grant of a European
patent.

The Representative,



J.C. Volmer

A00-40084/JV/NBR

CLAIMS for entry into national/regional phase of PCT/NL00/00747
(=WO-A1-01/29473) in the name of Stork Screens B.V.

CLAIMS

1. Thin-walled hollow cylinder (12) made from fibre-reinforced plastics material, comprising at least one layer (20; 32, 34; 32, 44, 46) having fibres (22) with at least one oriented direction of the fibres, the total wall thickness d^{tot} lying in the range from 0.010 to 1 mm, and the ratio d^{tot}/D being ≤ 0.0025 , where D is the diameter (in mm) of the cylinder.
2. Cylinder according to claim 1, characterized in that the fibre content is at least 45% by volume.
3. Cylinder according to claim 1 or 2, characterized in that the total wall thickness is in the range from 0.010 to 0.700 mm.
4. Cylinder according to claim 3, characterized in that the total wall thickness is in the range from 0.020 to 0.300 mm.
5. Cylinder according to one of the preceding claims, characterized in that the cylinder (12) comprises a fibre-reinforced layer having fibres with two oriented directions of the fibres.
6. Cylinder according to one of the preceding claims, characterized in that an oriented fibre direction lies parallel or perpendicular to the longitudinal axis of the cylinder (12).
7. Cylinder according to one of the preceding claims 1-4, characterized in that the cylinder (12) comprises a first layer having fibres in a first oriented direction of the fibres, and a second layer having fibres in a second oriented direction of the fibres, the oriented directions of the fibres not being identical.

8. Cylinder according to claim 7, characterized in that the oriented direction of the fibres of the first layer forms an angle α with the longitudinal axis of the cylinder (10), and the oriented direction of the fibres of the second layer forms an angle $-\alpha$ with the longitudinal axis of the cylinder (12).

9. Cylinder according to one of the preceding claims 7 or 8, characterized in that the cylinder (12) also comprises a further layer (32) having fibres (22) in a third oriented direction of the fibres, the direction of the fibres running parallel or perpendicular to the longitudinal axis of the cylinder (12).

10. Cylinder according to claim 9, characterized in that the said further layer (32) is present between the first layer (34) and the second layer (34).

11. Cylinder according to one of the preceding claims 7 or 9, characterized in that first layers having a first oriented direction of the fibres and second layers having a second oriented direction of the fibres alternate with one another.

12. Cylinder according to one of the preceding claims 1-3, characterized in that the cylinder (12) is of symmetrical structure in the thickness direction, and the oriented direction of the fibres of outermost, first layers (46) forms an angle α with the longitudinal axis of the cylinder (12), and the oriented direction of second, intermediate layers (44) forms an angle $-\alpha$ with the longitudinal axis of the cylinder (12).

13. Cylinder according to claim 12, characterized in that the cylinder comprises a further layer (32) having fibres (22) in a third oriented direction of the fibres, which direction of the fibres runs parallel or perpendicular to the longitudinal axis of the cylinder (12).

14. Cylinder according to claim 13, characterized in that the further layer (32) is arranged between the second, intermediate

layers (44).

15. Cylinder according to one of claims 9-10 or 12-14, characterized in that the layer thickness of the outermost first layers (46) is identical.

16. Cylinder according to one of claims 9-10 or 13-14, characterized in that the thickness of the further layer (32) is greater than the thickness of the other layers (34; 44, 46).

17. Cylinder according to one of the preceding claims, characterized in that the fibre-reinforced plastics material consists of unidirectional carbon fibres in an epoxy matrix.

18. Cylinder according to one of the preceding claims 1-3, characterized in that the cylinder (12) is made from a quasi-isotropic laminate.

19. Cylinder according to one of the preceding claims, characterized in that a surface layer, which does not contain any fibres, is provided on the inside and/or outside of the cylinder (12).

20. Cylinder according to one of the preceding claims 1-19, characterized in that the cylinder (12) is seamless.

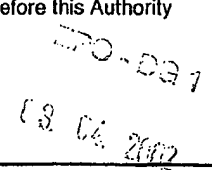



21. Use of a cylinder (12) according to one of the preceding claims 1-20 as a preform for the production of a printing forme for rotary screen printing, as a sleeve which is to be exchangeably fitted on an air roller for flexographic and offset printing, as a printing forme for gravure printing, as a transfer medium for transferring coatings and inks, as an electroforming mould or as a coating material.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference A00-40084/JV	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/NL00/00747	International filing date (day/month/year) 17/10/2000	Priority date (day/month/year) 18/10/1999
International Patent Classification (IPC) or national classification and IPC F16L9/12		
Applicant STORK SCREENS B.V. et al.		
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 4 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 1 sheets.</p> <div style="text-align: right; margin-top: 20px;">  </div>		
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> I <input checked="" type="checkbox"/> Basis of the report II <input type="checkbox"/> Priority III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability IV <input type="checkbox"/> Lack of unity of invention V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI <input type="checkbox"/> Certain documents cited VII <input type="checkbox"/> Certain defects in the international application VIII <input type="checkbox"/> Certain observations on the international application <div style="text-align: right; margin-top: 20px;">  </div>		
Date of submission of the demand 09/04/2001	Date of completion of this report 29.01.2002	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Duerhammer, M Telephone No. +49 89 2399 2743 <div style="text-align: right; margin-top: 20px;">  </div>	

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/NL00/00747

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, pages:

1-13 as originally filed

Claims, No.:

2-19 as originally filed

1 as received on 23/10/2001 with letter of 17/10/2001

Drawings, sheets:

1/2,2/2 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/NL00/00747

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes:	Claims	1-20
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-20
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-20
	No:	Claims	

- 2. Citations and explanations
see separate sheet**

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/NL00/00747

Section V,2:

Document US-A-3981 237 mentioned in the description discloses a thin-walled hollow cylinder made from fibre-reinforced plastics material (see column 9, last paragraph), comprising at least one layer having fibres, the total wall thickness lying in the range from 0,1 to 1 mm (the sheet thickness mentioned in column 4 lies within this range) and the ratio wall thickness/diameter of the cylinder being less than 0,0025 (for the diameter of the cylinder see column 8 and for the wall thickness see column 4, the quotient of both being less than 0,0025).

The device according to claim 1 differs therefrom in the sense that the fibres have at least one oriented direction and that the fibre content is at least 45%.

According to US-A-3981 237 a tubular blank is produced by extrusion methods from a thermoplastic polyester resin, either unfilled or filled with a reinforcing material such as glass fibres. It is generally known that the addition of fibres imparts an improved rigidity to plastics materials. These fibres may be added in the form of short fibres which are arbitrarily distributed in the plastics material and as unidirectional fibres.

The invention uses fibres in an oriented direction and in a content being at least 45%. With this arrangement and this volume concentration a sufficient strength and rigidity for the thin-walled hollow cylinder is achieved.

Because prior art does not give any indication to the orientation of the fibres and the volume concentration the present application meets the requirements of Article 33(2)(3) PCT.

Dependent claims 2 to 20 contain special embodiments of the cylinder according to claim 1 and likewise fulfil the requirement of Article 33(2)(3) PCT.

Reference is made to the fact that the description is not in conformity with the claims as required by Rule 5.1(a)(iii) PCT.

A00-40084/JV/NBR

International Patent Application PCT/NL00/00747
Annex to letter of October 17, 2001

Amended claim 1

Thin-walled hollow cylinder (12) made from fibre-reinforced plastics material, comprising at least one layer (20; 32,34; 32, 44, 46) having fibres (22) with at least one oriented direction of the fibres, the fibre content being at least 45%, the total wall thickness d^{tot} lying in the range from 0.010 to 1 mm, and the ratio d^{tot}/D being ≤ 0.0025 , where D is the diameter (in mm) of the cylinder.

PATENT COOPERATION TREATY

From the:
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

VOLMER, J.C.
EXTER POLAK & CHARLOUIS B.V.
P.O. Box 3241
NL-2280 GE Rijswijk
PAYS-BAS

Termijn:	24-10-01 ✓
Rec.:	26 JUL 2001
Opbergen:	TV

PCT

WRITTEN OPINION

(PCT Rule 66)

Date of mailing (day/month/year)	24.07.2001
-------------------------------------	------------

Applicant's or agent's file reference

A00-40084/JV

REPLY DUE

within 3 month(s)

from the above date of mailing

International application No.

PCT/NL00/00747

International filing date (day/month/year)

17/10/2000

Priority date (day/month/year)

18/10/1999

International Patent Classification (IPC) or both national classification and IPC

F16L9/12

Applicant

STORK SCREENS B.V. et al.

1. This written opinion is the first drawn up by this International Preliminary Examining Authority.

2. This opinion contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain document cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

3. The applicant is hereby invited to reply to this opinion.

When? See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also: For an additional opportunity to submit amendments, see Rule 66.4.
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis.
For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.

4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 18/02/2002.

Name and mailing address of the international preliminary examining authority:



European Patent Office
D-80298 Munich
Tel. +49 89 2399 - 0 Tx: 523656 epmu d
Fax: +49 89 2399 - 4465

Authorized officer / Examiner

Duerhammer, M

Formalities officer (incl. extension of time limits)

Haase, G

Telephone No. +49 89 2399 7532



WRITTEN OPINION

International application No. PCT/NL00/00747

I. Basis of the opinion

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed"*):

Description, pages:

1-13 as originally filed

Claims, No.:

1-19 as originally filed

Drawings, sheets:

1/2,2/2 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
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- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

WRITTEN OPINION

International application No. PCT/NL00/00747

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N) Claims 1

Inventive step (IS) Claims

Industrial applicability (IA) Claims

2. Citations and explanations

see separate sheet

Section V,2:

Document US-A-3981 237 mentioned in the description discloses a thin-walled hollow cylinder made from fibre-reinforced plastics material (see column 9, last paragraph), comprising at least one layer having fibres with at least one oriented direction of the fibres (all fibres are oriented in one direction), the total wall thickness lying in the range from 0,1 to 1 mm (the sheet thickness mentioned in column 4 lies within this range) and the ratio wall thickness/diameter of the cylinder is less than 0,0025 (for the diameter of the cylinder see column 8 and for the wall thickness see column 4, the quotient of both being less than 0,0025).

The present application does not meet the requirements of Article 33(2) PCT, because the subject-matter of claim 1 in its very broad formulation is not new.

It is not at present apparent which part of the application could serve as a basis for new claims which fulfil the requirement of Article 33 PCT. Should the applicant regard some particular matter as advantageous, claims should be filed delimited against prior art. The applicant should also indicate in the letter of reply the difference of the subject-matter of the new claims vis-à-vis the state of the art. Reference is made to the fact that, as mentioned above, also according to prior art hollow cylinders are produced from fibre-reinforced plastics material with a relatively great diameter and a small wall thickness which has good mechanical properties.

PATENT COOPERATION TREATY

PCT

REC'D 31 JAN 2002

WIPO PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference A00-40084/JV	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/NL00/00747	International filing date (day/month/year) 17/10/2000	Priority date (day/month/year) 18/10/1999
International Patent Classification (IPC) or national classification and IPC F16L9/12		EPO - DG 1 14. 02. 2001
Applicant STORK SCREENS B.V. et al.		

(37)

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 4 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 1 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 09/04/2001	Date of completion of this report 29.01.2002
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Duerhammer, M Telephone No. +49 89 2399 2743 

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. **PCT/NL00/00747**

I. Basis of the report

1. With regard to the elements of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, pages:

1-13 as originally filed

Claims, No.:

2-19 as originally filed

1 as received on 23/10/2001 with letter of 17/10/2001

Drawings, sheets:

1/2,2/2 as originally filed

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

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- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

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- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/NL00/00747

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)): ---

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims 1-20
	No:	Claims
Inventive step (IS)	Yes:	Claims 1-20
	No:	Claims
Industrial applicability (IA)	Yes:	Claims 1-20
	No:	Claims

- 2. Citations and explanations
see separate sheet**

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/NL00/00747

Section V,2:

Document US-A-3981 237 mentioned in the description discloses a thin-walled hollow cylinder made from fibre-reinforced plastics material (see column 9, last paragraph), comprising at least one layer having fibres, the total wall thickness lying in the range from 0,1 to 1 mm (the sheet thickness mentioned in column 4 lies within this range) and the ratio wall thickness/diameter of the cylinder being less than 0,0025 (for the diameter of the cylinder see column 8 and for the wall thickness see column 4, the quotient of both being less than 0,0025).

The device according to claim 1 differs therefrom in the sense that the fibres have at least one oriented direction and that the fibre content is at least 45%.

According to US-A-3981 237 a tubular blank is produced by extrusion methods from a thermoplastic polyester resin, either unfilled or filled with a reinforcing material such as glass fibres. It is generally known that the addition of fibres imparts an improved rigidity to plastics materials. These fibres may be added in the form of short fibres which are arbitrarily distributed in the plastics material and as unidirectional fibres.

The invention uses fibres in an oriented direction and in a content being at least 45%. With this arrangement and this volume concentration a sufficient strength and rigidity for the thin-walled hollow cylinder is achieved.

Because prior art does not give any indication to the orientation of the fibres and the volume concentration the present application meets the requirements of Article 33(2)(3) PCT.

Dependent claims 2 to 20 contain special embodiments of the cylinder according to claim 1 and likewise fulfil the requirement of Article 33(2)(3) PCT.

Reference is made to the fact that the description is not in conformity with the claims as required by Rule 5.1(a)(iii) PCT.

23-10-2001

NL000074

EPO - DG 1

A00-40084/JV/NBR

14. 02. 2001

International Patent Application PCT/NL00/00747
Annex to letter of October 17, 2001 --

(37)

Amended claim 1

Thin-walled hollow cylinder (12) made from fibre-reinforced plastics material, comprising at least one layer (20; 32,34; 32, 44, 46) having fibres (22) with at least one oriented direction of the fibres, the fibre content being at least 45%, the total wall thickness d^{tot} lying in the range from 0.010 to 1 mm, and the ratio d^{tot}/D being ≤ 0.0025 , where D is the diameter (in mm) of the cylinder.

Cylinder Sleeves for Flexography

An application overview on the manufacture and use of cylinder sleeves in flexographic printing — Part I.

by Michael Heckaman
Stork Cellramic, Inc.

Though not a new concept, sleeve use on cylinders has increased dramatically in recent years. Increasing pre-production costs, demands for Just-In-Time (JIT) delivery and desire for greater manufacturing flexibility have caused many flexo converters to adopt sleeves. Plate cylinder sleeves are best described as replaceable cylinder surfaces which can be quickly and easily mounted to or removed from a cylinder. Sleeves, nickel at least, may be used for the same purposes as the original cylinder surface. For flexo, the basic appeal of sleeves lies in their use as printing plate carriers. To be practical in flexo printing operations, sleeves must be easily changed, lightweight, cost effective, stable and reusable.

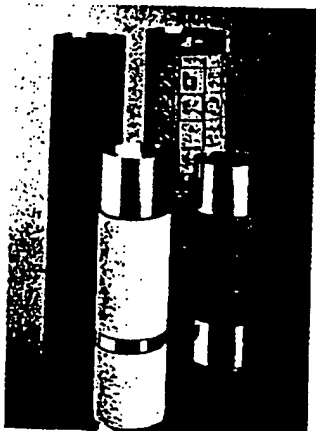


Plate-mounted cylinders.

Sleeves used as plate carriers allow the mounting, storage and reuse of printing plates, thereby eliminating the costs associated with reusing plates conventionally. Traditionally, plates would be demounted (subject to damage and replacement), stored (subject to change or damage) and remounted for each press run. When labor, stickyback and plate remake costs are accurately tracked, each repeat operation cost can easily reach 40 to 50 percent of the original. Plate cylinder inventories, previously tied up with already-mounted jobs, are available for regular use when plates are mounted and stored on sleeves.

Sleeve-mounted jobs allow scheduling flexibility since they need not be committed to run on any given press. Sleeves can be interchanged from one press cylinder to another of the same diameter but different journal configuration. They also allow for scheduling interruptions to run that extra hot job. The original job can then be completed without the time and cost of demounting and remounting two sets of plates. In the real world, plates are occasionally mounted in the wrong print direction. This presents little problem for sleeves, since the sleeve may simply be turned end-for-end and remounted. Sleeve-mounted plates make repeat-run reproduction more

like the original press run. Remaining as originally mounted, the sleeves can be positioned to the exact location on the same cylinder used in the original run. Maximum utilization of plate life is ensured when plates are left in position and stored on the sleeve. Since plates are not demounted, there is less likelihood of size change or damage during demounting, storage or remounting. Plate remakes necessitated by plate size change or damage often result in mismatched plates for the repeat runs.

Other Sleeve Uses

Sleeves may also carry continuous print designs produced with seamless rubber or photopolymer coverings which are usually applied directly to the cylinder. Some sleeve materials, notably nickel, will withstand high-temperature rubber vulcanization or surface application of seamless photopolymer layers. Exactly-registered print designs are produced in-the-round by laser-engraving the rubber, or by special exposure of the photopolymer layers. Sleeves may also be rubber- or photopolymer-covered to exact print repeats for use in tinting, lacquering or adhesive applications. Replacing cylinders in these applications will allow for a varied inventory of designs or coatings. Dedicated cylinder inventories and transport costs to and from roll producers are reduced when sleeves are used.

Sleeves may be rubber-covered in specific thicknesses to serve as cylinder build-ups. Existing cylinders can then print with thinner plates or larger repeats with standard plate thicknesses. Nickel sleeves can also provide protective, replaceable surfaces for plate cylinder surfaces. Used in this manner, sleeves would remain in place as a corrosion-resistant, metal cylinder surface. Replaced as needed, they provide a new, smooth surface at a fraction of the cost of reworking and replating the original cylinder surface. Precise, balanced plate cylinders could be maintained as such since the cylinder itself would not be subjected to wear or scoring.

Types of Sleeves

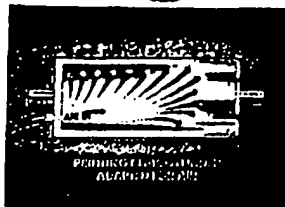
There are basically two types of sleeve systems: parallel (or cylindrical) and tapered (or conical). Parallel sleeves have constant and parallel inner/outer diameters and are designed to mount on cylindrical mandrels (existing plate cylinders). There are several manufacturers of parallel sleeve systems.

Tapered sleeves have a changing (tapered) inner diameter and constant outer diameter; they are designed to mount specially-manufactured and matched tapered mandrels. Parallel systems allow cylinders to be used with or without sleeves, while the tapered system must always be used with sleeves. Materials, manufacture and wall thicknesses used in sleeve manufacture include:

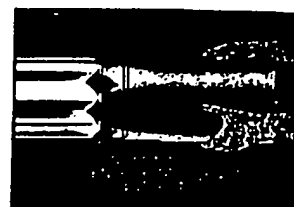
- **Nickel** - Electroformed seamless nickel cylinders; standard 0.005-inch wall thickness.
- **Fiberglass** - Resin-impregnated and cured multilayer glass fiber tubes; wall thicknesses 0.040 inch to 0.250 inch and up.
- **Fabric-Reinforced Resin** - Resin-coated and cured single-ply Kevlar fabric tubes; wall thicknesses 0.030 inch to 0.120 inch.
- **Polyester Laminate** - Adhesive-laminated polyester film tubes; standard 0.015-inch wall thickness, others available.

Sleeve manufacturers must ensure that: sleeve diameters are precisely made for each designated cylinder diameter with an interference to provide non-slip fits yet allow easy air mounting; materials have requisite elastic strength and memory to avoid stretch and slippage with repeated use; thicknesses are held to ± 0.0002 inch (± 5 microns) to ensure that plate cylinder Total Indicated Runout (TIR) is maintained at ≤ 0.0005 inch.

All sleeves — plated, coated or laminated — are manufactured on mandrels specifically sized to the required sleeve diameter. Each manufacturer should have an extensive mandrel inventory to accommodate the wide variety of sleeve diameters required to cover the flexographic printing repeat



Air to cylinder.



Position sleeve.

ranges. Sleeve sizes are designated by the Bare Cylinder Diameter (BCD) of the cylinder on which they are to be used. For example, sleeves ordered as 4.843 BCD will be mounted to cylinders of 4.843-inch undercut diameter (BCD). Sleeves are actually manufactured to a slightly smaller diameter (interference) to mount easily and to fit the designated cylinder size properly.

Most manufacturers have mandrels readily available for production of standard sleeve sizes. Standard sizes are based on plate cylinder undercuts of 0.125 inch for 10 diametral and 1/4 circular pitch gearing. Standard BCDs for a wide print repeat range are provided in published printing cylinder data sheets for these gearing systems. Additional to the standards, other mandrels are added as required for special size production.

Air Supply For Sleeve Mounting

Sleeves are mounted to cylinders using 80-100 psi air to enlarge the sleeve slightly and float it onto the cylinder with a frictionless air cushion. Upon air removal, sleeves retract with a tight, non-slip fit to the cylinder diameter. The general mounting procedure is:

(continued on page 96)

The only fully automated flexo inker that can save you \$ hundreds of thousands per year is no longer a concept

See the AUTOFlex Inker for yourself at FAMA 93 in Booth #1625



AUTOFlex Inker installed on an Kldder-Spacy 8750/1

- Applications:**
- All flexo printing/coating presses 18" - 2144" in width.
 - Single or double press systems.
 - 1 to 12 colors.
 - 1 to 12 stations.
- Unique Features:**
- Automated 5 minute wash-up of inker, anilox and doctor blades.
 - Automatic doctor blade setting.
 - No tools make ready.
 - No ink return pans or spare inkers.
 - Can run multiple colors on a single inker with no leak, please lubricated.
 - Radial seal technology.
- Production:**
- Up to 2,000,000 ft. per year.
 - 200,000 to 600,000 per year.
 - Dependent on the plant, press rate.
- Internal Rate of Return:**
- Over 100%.
- Guarantee:**
- Total system from interface to performance.

Compare - NO other inker (retrofit or OEM) comes close.

The FIT Group began running in June the initial batch of the over 100 AUTOFlex inker systems that are already on order and scheduled for installation in 1993. In fact, 80% of the orders are to replace existing chamber doctor systems from converters of paper, film, preprint linerboard, folding cartons and tissue. See why AUTOFlex is the now the new industry standard in flexo inking and coating.



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Flexo Inking Technologies

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BEGINNER FLEXOGRAPHER

(continued from page 77)

1. Sleeve is positioned over cylinder air outlets.
2. Air is supplied to cylinder through the inlet at the opposite end. Air escaping through outlet holes enlarges sleeve to approximately 0.001 inch over cylinder diameter.
3. Sleeve is floated into position on air cushion created by air escaping from outlet holes.
4. Sleeve retracts to grip the cylinder tightly when air is shut off.

Sleeves are removed from the cylinder by applying air and reversing the above procedure. Proper air supply is critical to the easy and successful mounting of sleeves. Most sleeve mounting difficulties are solved by increasing the air volume (not pressure) supplied to the cylinder. Supply air lines and fittings should be a minimum 1/4-inch inner diameter. Larger supply lines may be needed, depending on the length and configuration of the line from compressor to supply sites. It will occasionally be necessary to split the 1/4-inch supply line into two 1/8-inch lines and fittings for small diameter cylinders.

The air supply should be kept as dry as possible to avoid moisture entrapment between the mounted sleeve and cylinder surface. Bleed air lines regularly, and install moisture traps or drying units in the supply line when necessary. Oxidized films or mineral deposits from entrapped moisture can make mounted sleeves difficult to remove.

Cylinder Modifications For Sleeves

Cylinders need to be modified or manufactured to accept and release air for sleeve mounting. A fully-implemented sleeve operation can be attained with a minimum number of modified cylinders for each printing repeat. That number will be equal to the number of printing decks plus one additional cylinder to be used for plate mounting (six-color press, seven cylinders). This allows plate mounting of a given repeat job while another job of the same repeat is running on press. Once a plate color set is mounted to a sleeve and proofed, the sleeve is removed. Another sleeve is positioned on the cylinder for mounting and proofing the next color set.

Cylinders to be used with sleeves should have at least a 1/4-inch wall thickness and tight fitting or welded headers to contain the pressurized air. Most roll materials can be used to manufacture cylinders for sleeve usage. Preferred conventional materials would be stainless or chrome-plated steel, which offer corrosion protection against moisture contained in the air supply. The newer lightweight composite cylinders are ideally suited for sleeves when manufactured with a smooth, hard facing. Aluminum cylinders can be used with sleeves, but can present mounting difficulties. Their low hardness and surface oxidation render them easily scored and galled. Aluminum cylinders should be hard coated (anodized) for use as plate cylinders. Aluminum cylinders cannot be used as sleeve bases for rubber vulcanization because their greater

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FLEXO

thermal expansion at vulcanization temperatures will cause rubber covered sleeves to be oversized following the process.

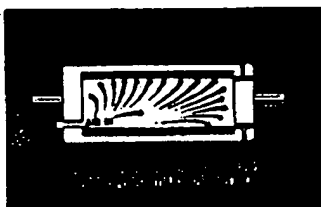
The criteria for sleeve cylinders, new or used, are nearly the same for good plate cylinders. The criteria are:

- Bare Cylinder Diameter (undercut) must be accurate for the targeted print repeat. Diameter tolerance should be $+0.001$ inch/ -0.000 inch.
- Straightness and TIR should be 0.0005 inch or less.
- Surface should be smooth and free of deep scratches, burrs, nicks or cut marks.
- Scribe lines should be kept to a minimum depth. To prevent their serving as air channels, they should not extend to the cylinder edges.

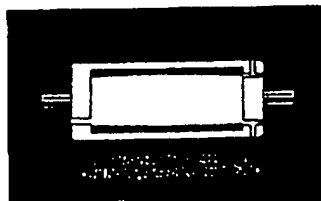
Air supply (inlet) holes for existing cylinders are usually drilled through the cylinder header. Cylinders configured for sleeve mounting during manufacture may be drilled either through the header or journal shaft. The air supply hole and outlet holes are at opposite ends of the cylinder. Outlet holes (6 to 8 required) should be 0.094 inch in diameter, equally spaced around the cylinder face circumference and located $5/8$ inch from the end. A slight bevel (20 degrees) on the outlet side will allow sleeves to be easily positioned over the holes for air mounting.

Cylinder Maintenance

The cylinder surfaces should be kept clean and free of oils, ink, dirt and adhesive residues. Before mounting sleeves, the surface should be cleaned and wiped completely dry. A light wipe with WD-40™ will help maintain the surface. Wipe the surface vigorously with a dry cloth to remove excess fluid.



Slide sleeve in place.



Disconnect air.

Oils or lubricants should never be used to assist sleeve mounting to the cylinder. These are counterproductive and actually make mounting even more difficult. The best results are always obtained with cylinder surfaces that are smooth, clean and dry. Periodically check to see that cylinder air outlets are free and clear of any obstruction that may have been introduced from the cylinder interior.

Sleeves should be removed from cylinders upon completion of the press run. Sleeves stored on cylinders for long periods may become locked to the cylinder surface by an oxidized film or mineral deposits from entrapped moisture. ■

Part II, which will appear next month, will address sleeve mounting, demounting, storage and combination techniques.

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